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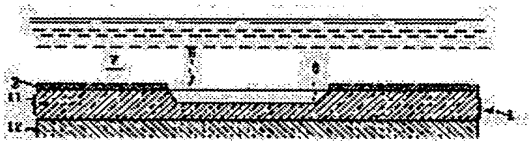
(54) PRODUCTION OF THIN FILM MAGNETIC HEAD

(57)Abstract:
PURPOSE: To obtain a production method of a thin film magnetic head excellent in industrial productivity by which depth of recesses and the pattern where a magnetic convertor element is to be arranged can be controlled at high accuracy and decrease in the pattern accuracy due to redeposition can be prevented.
CONSTITUTION: After a metal film 2 is deposited on on surface of a substrate 1, the metal film 2 is patterned in such a manner that the surface of the substrate 1 is exposed in a pattern 5 corresponding to th recessed pattern. Then the substrate 1 is dipped in an etching liquid 7 for selectively etching the substrate 1 to form recesses 6 on the surface of the substrate 1 with the metal film 2 as a mask.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] It is the method of manufacturing the thin film magnetic head which has a crevice on the whole surface of a substrate and formed a magnetic sensing element or its component on the aforementioned crevice. the 1st process After adhering a metal membrane on the front face of the aforementioned substrate, as the front face of the aforementioned substrate is exposed with the pattern corresponding to the pattern of the aforementioned crevice, it is the process which carries out patterning of the aforementioned metal membrane. the 2nd process The manufacture method of the thin film magnetic head which is the process which is immersed in the aforementioned substrate into the etching reagent which **********s the aforementioned substrate alternatively, and forms the aforementioned crevice on the front face of the aforementioned substrate by using the aforementioned metal membrane as a mask after the 1st process of the above.
[Claim 2] The aforementioned substrate is the manufacture method of the thin film magnetic head according to claim 1 that a surface layer becomes with metallic-oxide system ceramic material.
[Claim 3] The 1st process of the above is the manufacture method of the thin film magnetic head according to claim 1 which is the process which carries out patterning of the aforementioned metal membrane by chemical etching.
[Claim 4] **** in which the aforementioned crevice has the degree of tilt angle whose inside side is five - 90 degrees -- the manufacture method of a certain thin film magnetic head according to claim 1
[Claim 5] The aforementioned magnetic sensing element is the manufacture method of the thin film magnetic head according to claim 1 of being an induction-type element containing a magnetic core, a coil film, and a gap film, and adhering to a part of aforementioned magnetic core in the aforementioned crevice.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the manufacture method of the thin film magnetic head.
[0002]
[Description of the Prior Art] A crevice is prepared on the whole surface of a substrate and the thin film magnetic head in which the magnetic sensing element was formed on the crevice, and the formation method of a crevice are already learned. For example, JP,60-193114,A is indicating a means to form a crevice with machining which used the blade. Moreover, after JP,1-211311,A applies a resist on a substrate, it heats a substrate, carries out the flow of the resist, next uses this resist as a mask, **********s a substrate using ion beam etching or the mixed etching reagent of HF and HNO3, and is indicating the technology which forms a crevice.
[0003]
[Problem(s) to be Solved by the Invention] By the way, a thing controllable [the depth] since the depth and pattern precision of a crevice participate in the property of the magnetic sensing element formed on it directly when preparing a crevice on the whole surface of a substrate, Moreover, the thing for which the reattachment of the droplet by which have been generated [that the pattern precision of a crevice can be demarcated with high degree of accuracy and] from the substrate in a crevice formation process is prevented certainly, and the fall of the pattern precision by the reattachment can be prevented, And when industrial productivity is taken into consideration, it is very important that the etching speed which crevice formation takes is quick etc.
[0004] However, the conventional technology mentioned above was not enough to fill these demands. For example, since the technology indicated by JP,60-193114,A is machining, it is difficult to have the precision demanded in this kind of technology, and to control the depth of a crevice. Since the technology indicated by JP,1-211311,A constitutes a patterning mask by the resist, it tends to produce a pattern defect of shape. In order to form a crevice by ion beam etching, there are difficulties, like that it is easy to produce the fall of the pattern precision by the reattachment, a pattern defect of shape, etc. and an etch rate is slow.
[0005] The technical problem of this invention is offering the manufacture method of the thin film magnetic head the depth of the crevice which arranges a magnetic sensing element being controlled certainly.
[0006] Another technical problem of this invention is offering the manufacture method of the thin film magnetic head the pattern of a crevice being demarcated with high degree of accuracy.
[0007] It is offering the manufacture method of the thin film magnetic head which does not cause the fall of a pattern precision according [another technical problem] to the reattachment further of this invention.
[0008] It is offering the manufacture method of the thin film magnetic head of this invention another technical problem's having been further excellent in industrial productivity.
[0009]
[Means for Solving the Problem] this invention has a crevice on the whole surface of a substrate for the technical-problem solution mentioned above, and the 1st following process and the 2nd process are included in manufacturing the thin film magnetic head in which a magnetic sensing element or its component was formed on the aforementioned crevice.
[0010] First, after adhering a metal membrane on the front face of the aforementioned substrate, the 1st process is a process which carries out patterning of the aforementioned metal membrane, as the front face of the aforementioned substrate is exposed with the pattern corresponding to the aforementioned crevice pattern.
[0011] The 2nd process is a process which is immersed in the aforementioned substrate into the etching reagent which **********s the aforementioned substrate alternatively, and forms the aforementioned crevice on the front face of the aforementioned substrate by using the aforementioned metal membrane as a mask after the 1st process of the above.
[0012] Generally, a substrate becomes with the metallic-oxide system ceramic material of aluminum 2O3 and SiO2 grade. Preferably, the 1st process of the above includes the process which carries out pattern INGU of the aforementioned metal membrane by chemical etching. **** in which, as for the aforementioned crevice obtained by this invention, a medial surface has the degree of tilt angle which is five - 75 degrees -- a certain thing is desirable The aforementioned magnetic sensing element is an induction-type element containing a magnetic core, a coil film, and a gap film as an example, and it adheres to a part of aforementioned magnetic core in the aforementioned crevice.
[0013]
[Function] The 2nd process is immersed in a substrate into the etching reagent which **********s a substrate alternatively among the metal membrane given by the 1st process and a substrate, and uses a metal membrane as a mask. Since it is the process which forms a crevice on the surface of a substrate, the depth and the degree of tilt angle of a crevice which should arrange a magnetic sensing element, its component, for example, the lead section, or an electrostatic-discharge prevention pattern can be certainly controlled by controlling the solution temperature of an etching reagent, composition, etc.
[0014] In the 1st process, since patterning of the metal membrane is carried out and this metal membrane is used as a mask so that the front face of a substrate may be exposed with the pattern corresponding to the crevice pattern after adhering a metal membrane on the whole surface of a substrate, as compared with the conventional example using a resist pattern mask, the pattern of a crevice can be demarcated with high degree of accuracy. Moreover, it becomes possible to control the depth and the degree of tilt angle of a crevice by high degree of accuracy broadly for the above-mentioned property of a metal membrane.

[0015] Since the pattern of a crevice is formed of the wet etching which used the etching reagent, unlike dry etching, such as ion beam etching, it does not cause the fall of the pattern precision by the reattachment.
[0016] Furthermore, since the pattern of a crevice is formed of the wet etching which used the etching reagent, as compared with dry etching, such as ion beam etching, 1 or more figures of etch rates become quick. And a batch production etc. is possible. For this reason, industrial productivity improves remarkably.
[0017]
[Example] Drawing 1 - drawing 10 are drawings which explain sequentially the manufacturing process of the thin film magnetic head concerning this invention. It has a crevice on the whole surface of a substrate, and the 1st process and the 2nd process are included in manufacturing the thin film magnetic head in which the magnetic sensing element was formed on the crevice. It may have a crevice not only for the magnetic sensing element itself but for for example, the lead section or an electrostatic-discharge prevention pattern. After the 1st process is shown in drawing 1 - drawing 6 and adheres a metal membrane on the whole surface of a substrate, it is a pattern corresponding to the crevice pattern, and it includes the process which carries out patterning of the metal membrane so that the front face of a substrate may be exposed. First, a substrate 1 is prepared as shown in drawing 1 . As for a substrate 1, a surface layer 11 changes in the metallic-oxide ceramic material 2O3, for example, aluminum, and SiO2 grade. Usually, a substrate 1 is given as a wafer and has structure which carried out the laminating of the surface layer 11 mentioned above on the base 12 which becomes by aluminum2O3-TiC, and prepared it. A surface layer 11 has 5 micrometers - about 20 micrometers thickness.
[0018] Next, a metal membrane 2 is made to adhere on the whole surface of the surface layer 11 of a substrate 1, as shown in drawing 2 . Metal membranes 2 are films, such as titanium or a permalloy. Such a metal membrane 2 can be formed by the spatter, vacuum evaporationo, plating, or those combined use. When using plating, not only electroplating but an electroless deposition method can also be used.
[0019] Next, the photosensitive resist film 3 is made to adhere to the front face of a metal membrane 2, as shown in drawing 3 . The resist film 3 is which type of a negative and a positive, and can use widely a curly grain and the photosensitive resist known from before. The spin coat method etc. can be used in the adhesion.
[0020] Next, the resist film 3 is exposed and developed according to a photolithography process, and as shown in drawing 4 , the pattern 4 corresponding to the required crevice pattern is formed. A metal membrane 3 is exposed to the interior of this pattern 4.
[0021] Next, as shown in drawing 5 , the metal membrane 3 in the pattern 4 surrounded with the photosensitive resist film 3 is **********ed along with a pattern 4, and the pattern 5 to which the front face of a substrate 1 is exposed by it is formed. A metal membrane 3 can carry out patterning by ion milling or the dry etching by ion beam etching, and the wet etching using chemical etching liquid. When harnessing the advantage that an etch rate is early, it is desirable to use wet etching.
[0022] Then, using the solvent suitable for the photosensitive selected resist film 3, as shown in drawing 6 , the photosensitive resist film 3 is removed.
[0023] The 2nd process is illustrated by drawing 7 - drawing 10 , is immersed in a substrate 1 into the etching reagent which **********s a substrate 1 alternatively among a metal membrane 2 and a substrate 1 after the 1st process, and includes the process which forms a crevice 6 in the front face of a substrate 1. That is, as shown in drawing 7 , the substrate 1 which has the pattern 5 by the metal membrane 3 is immersed in a substrate 1 among a metal membrane 2 and a substrate 1 into the etching reagent 7 which **********s alternatively. The crevice 6 which followed the pattern 5 by using a metal membrane 2 as a mask by this being immersed is formed. Depth d of a crevice 6 is about several micrometers. An etching reagent 7 may be which type of alkali and an acid. As an etching reagent 7 which was suitable when the surface layer 11 of the substrate 1 which should form a crevice 6 became with the metallic-oxide system ceramic material of aluminum 2O3 and SiO2 grade, as mentioned above, calcium(OH)2 solution, a KOH solution, or a NaOH solution can be mentioned.
[0024] Since it is the process which the 2nd process is immersed in a substrate 1 into the etching reagent 7 which **********s a substrate 1 alternatively among the metal membrane 3 given by the 1st process and a substrate 1, uses a metal membrane 3 as a mask here, and forms a crevice 6 in the front face of a substrate 1, depth d of the crevice 6 which arranges a magnetic sensing element can be certainly controlled by controlling the solution temperature of an tching reagent 7, composition, etc. Drawing 11 is drawing showing the relation between the solution temperature at th time of using the solution of the composition mentioned above as an etching reagent 7, and an etch rate. Since an etch rate becomes large as solution temperature becomes high so that clearly from drawing 11 , the etching depth per unit time is controllable by controlling solution temperature. Moreover, the amount of etching is controllable by controlling etching time.
[0025] And in the 1st process, since patterning of the metal membrane 2 has been carried out so that the front face of a substrate 1 may be exposed with the pattern corresponding to the crevice pattern after adhering a metal membrane 2 on the whole surface of a substrate 1, as compared with the conventional example using a resist pattern mask, the pattern of a crevice 6 can be demarcated with high degree of accuracy. It is because the fall of the pattern precision produced between wet etching processes becomes smaller than the case of a resist mask when a metal membrane 2 is used. Moreover, it becomes possible to control the depth and the degree of tilt angle of a crevice 6 for the above-mentioned property of a metal membrane 2.
[0026] Furthermore, since the pattern of a crevice 6 is formed of the wet etching which used the etching reagent 7, unlike dry etching, such as ion beam etching, it does not cause the fall of the pattern precision by the reattachment.
[0027] Furthermore, as compared with dry etching, such as ion beam etching, as for the wet etching using the etching reagent, 1 or more figures of etching speed become quick. And a batch production etc. is possible. For this reason, industrial productivity improves remarkably.
[0028] the range whose degree theta of tilt angle is 5 - 90 degrees in order that the medial surface 61 of the crevice 6 formed of the above-mentioned etching may acquire a desirable magnetic-circuit property, when making a part of magnetic core of a magnetic sensing element adhere in a crevice 6 -- preferably, it sets up so that it may become 45 - 75 degr es When forming a lower magnetic film in the interior of a crevice 6 by a part of magnetic core, by attaching an angle to a medial surface 61, narrowing [of a point] down becomes steep, a strong write-in magnetic field is acquired with reduction of a disclosure magnetic field, and shell density record is attained. Especially the range of the 45 - 75 degrees of tilt angle is desirable from a viewpoint of disclosure magnetic field reduction, reinforcement of a strong write-in magnetic field, and the ease of ramp patterning. This degree theta of tilt angle can be adjusted by controlling an etch rate.

[0029] Then, as shown in drawing 9 , it applies to the front face of the substrate 1 of the circumference of it from the interior of a crevice 6, and the lower magnetic film 8 which constitutes a part of magnetic core of a magnetic sensing element is formed, and as shown in drawing 8 , after removing a metal membrane 2, as shown in drawing 10 , the magnetic sensing element 9 is further formed on the lower magnetic film 8. The structure of the magnetic sensing element 9 is common knowledge. As a concrete example, drawing 10 shows the induction type MAG sensing element which has the gap film 91, the lower magnetic film 8, the up magnetic film 92 which makes a pair and the coil film 93, and the coil layer insulation film 94.
[0030] Although illustration is not carried out, this invention is widely applicable as a means to form other crevices which embed a part or all of a magnetic sensing element.
[0031]
[Effect of the Invention] According to this invention, the following effects can be acquired as stated above.
(a) The manufacture method of the thin film magnetic head that the depth of the crevice which arranges a magnetic sensing element can be controlled certainly can be offered.
(b) The manufacture method of the thin film magnetic head that the pattern of a crevice can be demarcated with high degree of accuracy can be offered.
(c) The manufacture method of the thin film magnetic head which does not cause the fall of the pattern precision by the reattachment can be offered.
(d) The manufacture method of the thin film magnetic head excellent in industrial productivity can be offered.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing explaining the manufacturing process of the thin film magnetic head concerning this invention.
[Drawing 2] It is drawing explaining the manufacturing process after the manufacturing process of drawing 1 .
[Drawing 3] It is drawing explaining the manufacturing process after the manufacturing process of drawing 2 .
[Drawing 4] It is drawing explaining the manufacturing process after the manufacturing process of drawing 3 .
[Drawing 5] It is drawing explaining the manufacturing process after the manufacturing process of drawing 4 .
[Drawing 6] It is drawing explaining the manufacturing process after the manufacturing process of drawing 5 .
[Drawing 7] It is drawing explaining the manufacturing process after the manufacturing process of drawing 6 .
[Drawing 8] It is drawing explaining the manufacturing process after the manufacturing process of drawing 7 .
[Drawing 9] It is drawing explaining the manufacturing process after the manufacturing process of drawing 8 .
[Drawing 10] It is drawing explaining the manufacturing process after the manufacturing process of drawing 9 .
[Drawing 11] It is drawing showing the relation between solution temperature and etching speed.
[Description of Notations]
1 Substrate
2 Metal Membrane
6 Crevice
7 Etching Reagent

[Translation done.]